

(19) World Intellectual Property Organization International Bureau



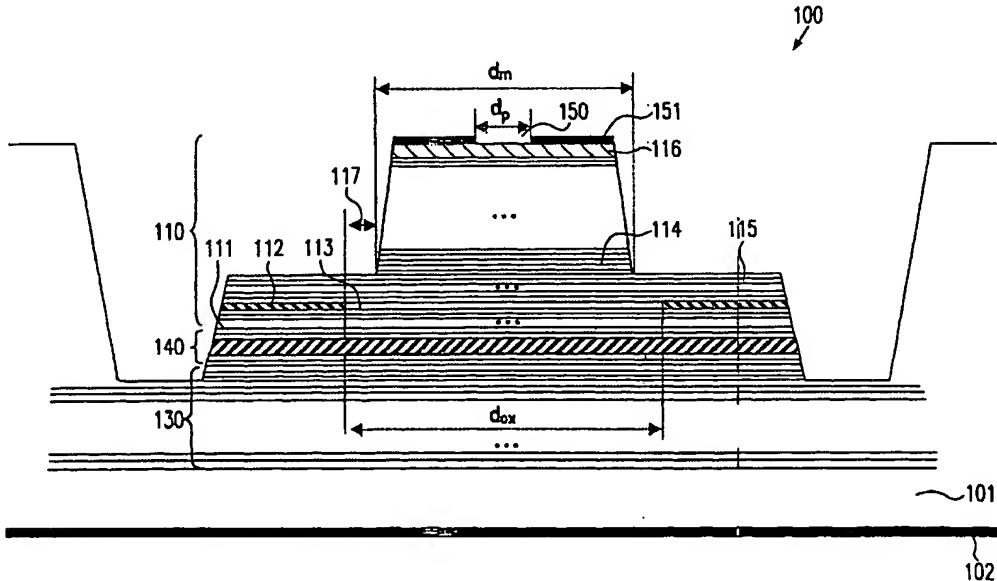
(43) International Publication Date  
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number  
**WO 2005/006509 A1**

- |   |   |   |
|---|---|---|
| (51) International Patent Classification <sup>7</sup> : | H01S 5/183  | (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW. |
| (21) International Application Number:                  | PCT/EP2004/007386   |   |
| (22) International Filing Date:                         | 6 July 2004 (06.07.2004)  |   |
| (25) Filing Language:                                   | English   |   |
| (26) Publication Language:                              | English   |   |
| (30) Priority Data:                                     | 03015307.6 7 July 2003 (07.07.2003) EP  |   |
| (71) Applicant (for all designated States except US):   | AVALON PHOTONICS AG [CH/CH]; Badenerstrasse 569, CH-8048 Zurich (CH).                                   |   |
| (72) Inventor; and                                      |   |   |
| (75) Inventor/Applicant (for US only):                  | ROYO, Paul [CH/CH]; Doeltschihalde 29, CH-8055 Zurich (CH).   |   |
| (74) Agent:   | PFAU, Anton; Grünecker, Kinkeldey, Stockmair & Schwanhäusser, Maximilianstrasse 58, 80538 München (DE). |   |
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— with international search report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A VERTICAL HAVING IMPROVED TRANSVERSE MODE CONTROL BY OPTIMIZING THE INCREASED OXIDE APERTURE RELATIVE TO THE LASER DIMENSIONS



(57) Abstract: The present invention provides a VCSEL device (100) and a method of fabricating the same, wherein two or more characteristic device dimensions ( $d_m$ ,  $d_p$ ) are correlated with each other so as to optimise single mode emission, while at the same time significantly providing an increased oxide aperture ( $d_{ox}$ ) compared to conventional devices. Thus, device lifetime and reliability are enhanced. The present invention may rely on well-established process techniques for VCSEL devices having an oxide aperture ( $d_{ox}$ ), wherein merely one additional mesa etch step is required.

**WO 2005/006509 A1**